

Claim 7, line 14 delete "and" and at line 22 after "fiber" insert --and combinations thereof--.

Claim 13, line 19, delete "13" and insert -- 12 --.

15. (Amended) A functionally-graded metal substrate comprising:

a functional insert;

a surrounding body;

as wherein the functional insert and the surrounding body are two different metal compositions in the x-y plane of the substrate[;], the functional insert having a higher thermal conductivity and higher coefficient of thermal expansion than the surrounding body and the surrounding body having a lower thermal conductivity and lower coefficient of thermal expansion than the functional insert;

wherein the surrounding body surrounds the functional insert in at least two dimensions;

wherein the functional insert extends from a top surface of the functionally-graded metal substrate to the bottom surface of the substrate;

wherein the functional insert [and the surrounding body] comprises a metal composition selected from the group consisting of copper, nickel, iron, beryllium, aluminum, silver; copper-beryllium, copper-zinc (bronze), copper-tin (brass), [64% iron/36% nickel (Invar™) and 54% iron/29% nickel/17% cobalt (Kovar™)], copper-iron, nickel-niobium, nickel-silver, nickel-copper, iron-copper, iron-copper-carbon, iron-copper-nickel, iron-chromium, iron-copper-tin, copper-nickel-titanium-aluminum, nickel-copper-titanium, copper/tungsten, copper/molybdenum, aluminum/silicon carbide, aluminum/aluminum nitride, copper/aluminum, silver/Invar™, copper/cubic boron nitride, copper/diamond and copper/high conductivity carbon fiber and combinations thereof; [and,]

wherein the surrounding body comprises a metal composition selected from the group consisting of copper, nickel, iron, beryllium, aluminum, silver, copper-beryllium, copper-zinc

(bronze), copper-tin (brass), 64% iron/36% nickel (Invar™), 54% iron/29% nickel/17% cobalt (Kovar™), copper-iron, nickel-niobium, nickel-silver, nickel-copper, iron-copper, iron-copper-carbon, iron-copper-nickel, iron-chromium, iron-copper-tin, copper-nickel-titanium-aluminum, nickel-copper-titanium, copper/tungsten, copper/molybdenum, aluminum/silicon carbide, aluminum/aluminum nitride, copper/aluminum, silver/Invar™, copper/cubic boron nitride, copper/diamond and copper/high conductivity carbon fiber and combinations thereof; and,

AS
cont. wherein the functionally-graded metal substrate has a density of at least about 90% of theoretical.

16. (Amended) A functionally-graded metal substrate comprising:

a functional insert;

a surrounding body;

wherein the functional insert and the surrounding body are two different metal compositions in the x-y plane of the substrate;

wherein the functional insert has a higher thermal conductivity and higher coefficient of thermal expansion than the surrounding body, and the surrounding body has a lower thermal conductivity and lower coefficient of thermal expansion than the functional insert;

wherein the surrounding body surrounds the functional insert in at least two dimensions;

wherein the functional insert extends from a top surface of the functionally-graded metal substrate to the bottom surface of the substrate;

wherein the surrounding body is a copper/tungsten MMC containing from about 5% to about 50% by weight copper, and wherein the functional insert is a copper/tungsten MMC containing from about 20% to about 80% copper; and,

wherein the functional insert has a thermal conductivity that ranges from about 200 W/mK to about 400 W/mK and wherein the surrounding body has a CTE that ranges from about 5.6 ppm/°C to about 7.0 ppm/°C.

Claim 17, line 7, after "substrate" insert -- of Claim 16 --.

18. (Amended) A process for making a functionally-graded metal substrate, the process comprising:

filling the cavity of a metal body with a functional insert powder composition;

and,

sintering the functional insert powder composition to produce a substrate having a functional insert that is bonded to a surrounding body.

Claim 19, line 17, delete "19" and insert -- 18 --.

Claim 20, line 32, delete "19" and insert -- 18 --.

Claim 21, line 12, delete "19" and insert -- 18 --.

Claim 22, line 15, delete "22" and insert -- 18 --.

Claim 23, line 18, delete "23" and insert -- 18 -- and delete "sintered".

Claim 24, line 21, delete "19" and insert -- 18 --.

Claim 25, line 29, delete "25" and insert -- 24 --.

Claim 26, line 34, delete "19" and insert -- 18 --.

Claim 27, line 9, delete "27" and insert -- 26 --.

line 11, after "both" insert -- with a molten metal compound --.

Claim 28, line 13, delete "26" and insert -- 27 --.

Claim 29, line 18, delete "29" and insert -- 28 --.

Claim 30, line 26, delete "30" and insert -- 29 --.

31. (Amended) The process of Claim [26] 18 wherein the functional insert powder composition contains at least one metal powder and wherein the sintering temperature is about equal to or greater than the melting temperature or the eutectic temperature of at least one metal [composition] powder.

Claim 33, line 15, delete "33" and insert -- 32 --.

Claim 34, line 18, delete "34" and insert -- 33 --.

Claim 35, line 27, delete "35" and insert -- 34 --.

Claim 36, line 33, delete "The" and insert -- A -- and in line 35, delete "comprises" and insert -- comprising --.

Claim 37, line 12, delete "The" and insert -- A --.

Claim 38, line 20, delete "38" and insert -- 37 --.

⌞ Please add Claims 39-41 as follows:

all 39. The functionally-graded metal substrate of Claim 12 wherein the heat-generating component is attached to the functional insert and the surrounding body constrains the dimensional expansion of the functional insert in the x-y plane during thermal cycling.

40. The functionally-graded metal substrate of Claim 17 wherein the functional insert physically accommodates the heat-generating component to facilitate heat transfer and the surrounding body constrains the dimensional expansion of the functional insert in the x-y plane during thermal cycling.

41. The process of Claim 35 wherein the functional insert has a thermal conductivity that is greater than the surrounding body and the functional insert physically accommodates the heat-generating component to facilitate heat transfer, and wherein the surrounding body has a CTE that is lower than the functional insert and the surrounding body constrains the dimensional expansion of the functional insert in the x-y plane during thermal cycling.

REMARKS

⌞ Applicant wishes to amend this application preliminary to the review by the Examiner.

⌞ No new matter has been added as all amendments are supported by the original application. In